

18918

49  
B

S. Cripps 701

A  
**COMPANION**  
 TO THE  
**SYNOPSIS of the UNIVERSE,**  
 OR  
**DESCRIPTIVE GUIDE**  
 TO THE  
**PLATES.**

EXHIBITING THE  
*Northern and Southern Sideral Hemispheres,*  
 AS FORMING CONCAVES OVER THE  
**SOLAR SYSTEM**

Whose Integral PLANETS are delineated in their Positions  
 for the 21st Day of JUNE 1798, with the Places of their  
 NODES, the Inclination of their AXIS, the Obliquities of  
 their ORBITS, &c. exemplified by Delineation,

TOGETHER WITH  
 A SUMMARY ACCOUNT of the COMET which appeared  
 in the Summer 1797, with the same laid down in its Si-  
 tuation on the 22d of August.

BY THE AUTHOR OF THE  
**PLANISPHERICAL PLANETARIUM.**

J. B. Watson

When I behold this goodly Frame, this World  
 Of Heav'n and Earth confisting, and compare  
 Their magnitudes; this Earth, a spot; a grain,  
 An atom, with the Firmament compar'd  
 And all her number'd Stars; reas'ning I oft  
 Admire.

MILTON.

**LONDON:**

Published by W. CLARKE, No. 38, New Bond Street, and  
 J. WAINMAN, No. 16, Ludgate Street,  
 1798.

COMPANION  
TO THE  
PATENT  
OFFICE





## SYNOPSIS *of the* UNIVERSE.

A KNOWLEDGE of the Solar System, both with respect to its constituent parts, and the relative positions of those parts to the Fixed Stars, is an indispensable assistant to the Study of the Globes: For, as neither the artificial Globes, nor the natural motion of the Planets in the Heavens\*, convey

\* A view of the Heavens at night so little contributes to elucidate the Planetary Orbs, or their motions, that the multiplicity and similitude of the heavenly objects frequently confound the mind of a young student, who seeing the Planets with astral appearances, and apparently ranging among the fixed stars, naturally conceives them to be of the like nature with the stars themselves. This is to be attributed to the imperfection of our vision; for were he to view the Heavens through a telescope, he would then discover that those Planets which appeared to his unassisted sight like stars, are bodies of great magnitude, with motions and maculæ; whereas the fixed Stars would appear abated in lustre, and diminished in magnitude. This decidedly evinces the difference of the bodies, and in-

B

disputably



convey an adequate idea of those revolutions and relative situations, it requires a peculiar delineation to impress it. The present Projections are submitted for that purpose, and exhibit a general view both of the Fixed Stars and Planetary Orbs, comprehending in representation as much of the expansive Universe as comes within the scope of man's natural perception. They possess the peculiar property of each giving a duplicate representation, viz. of a *Plane* and an *Hemisphere*, the surface of each Plate representing the Plane of the Earth's orbit, and the astral representatives exhibiting the Fixed Stars as forming Hemispheres over the Solar System, convex to

disputably proves the immense distance of the fixed stars. The Planets shine by the reflection of that light which the Sun impinges on them ; and, from their proximity to us, we are enabled to see them ; for were they removed to the distance of the fixed stars, they would be perfectly invisible to us ; indeed, one of Jupiter's Satellites is supposed to be larger than our Earth, yet at the distance of Jupiter's orbit it is not visible to the naked eye. The brilliancy with which the Planets shine, depends either on their bulk or distance ; but the lustre of the fixed stars, and the variety of their apparent magnitudes, are attributed chiefly to their distance : it is conceived *that they are equal in bulk and equally luminous*, but that those of inferior magnitude are more remote from us than those of superior, and consequently impart to us less of their light, whereby alone we can form our judgment.

the





the observer's eye, but concave to the Planets of the System.

The Synopsis represents the Universe bisected in that line of distinction wherein we always see the Sun's centre, viz. the Ecliptic, by reason that this bisection becomes the exact plane wherein the earth moves in its annual orbit round the Sun; whereby in one projection we have a view of the Fixed Stars north of the Ecliptic, and the northern hemispheres of the Sun and Earth; in the other a view of the Fixed Stars south of the Ecliptic, and the southern hemispheres of the Sun and Earth.

The other Planets of the System are not bisected by this plane, because their orbits are not parallel thereto, but are inclined to it in inconsiderable angles; so that, as the lines of their orbits intersect the plane of the Ecliptic or Earth's orbit, they consequently in their annual revolutions become half of their year north and the remainder south of the Ecliptic. If it had occurred that either of them had been in their respective Nodes on the particular days for which they are laid down in the Synopsis, then such would have been bisected by this plane, and its northern hemisphere delineated in the Northern projection, and its southern in the Southern; in like manner as the Earth. But for the purpose of distinguishing the relative

positions of the Planets to the plane of the Earth's orbit, those are laid down in the Northern Hemisphere \* which are in northern declination, and those in the Southern Hemisphere which are in southern declination, on the particular day for which the planetary representatives are projected, viz. the 21st of June 1798.

The obliquities of the orbits of the respective Planets, are particularly illustrated by the annexed diagram, which is a bisection of the Universe at right angles with the plane of the Ecliptic. The plane of the Earth's orbit is represented by the dotted line, and is always considered parallel, because it is the datum from which the inclinations of the other Planetary Orbits are computed: thus, if a line was drawn to the circle, parallel to the small central line (the representative of the obliquity of Mercury's orbit), and the arc of the quadrant measured between the dotted

\* The word *Hemisphere* is equally applied to the half of a planetary body, and to that vast concave of stars which we see overarch our earth. All the Planets are found to be globular; and as we can never see more than half of a globe at once, in looking at one of them we doubtless view a hemisphere; and as the rotundity of our Earth, which, we are well assured, is spherical, intercepts our view of more than half the great sphere of Heaven—for the sake of explicit distinction between the two, the Astral Hemisphere is exclusively inserted with a capital.

ecliptic plane and the line terminating at the circle, it would give  $6^{\circ} 54'$ , the inclination of Mercury's orbit to the plane of the Earth's orbit; and so of the others.

This is a view of the System horizontally, or along the plane of the Earth's orbit, whereas in the Synopsis the eye is looking down upon the System from the poles of the Ecliptic; but at an elevation in the universe beyond the Stars of the 5th magnitude. The Planets are represented with the due inclinations of their axis to their orbits, so that we only see the northern poles and hemispheres of those planets which are in north declination, and the southern of those which are in south declination.

All the Planets are observed to revolve in their orbits in the same direction, though that direction may vary with the observer's situation, for as we view them from the earth they appear to move (in their progressive revolution) from west to east; but to an eye placed in the north pole of the ecliptic, they would appear to revolve from east to west, and to an eye placed in the south pole, from west to east; as from these sites the projections of the Synopsis are made, we must be particular in this respect, and recollect that an object in circular motion between two persons, face to face, or the same person in two opposite situations, has always a contrary appearance; for instance, a ball whirling  
round



round a table, while it is coming from the left to the right of one person, will be moving from the right to the left of the other, and so invariably contrary:—thus views of our motionary system from different parts of the Universe will have opposite appearances. So may it be observed in the Synopsis; viewing the Northern Hemisphere, the Planets appear to revolve from East to West, and in the Southern projection, where the site of view is reversed, from West to East\*.

The secondary Planets, or the Satellites of the primitive, are observed to revolve in orbits nearly coincident with those of their primitives, and to perform their revolutions in a correspondent manner,

As each Planet crosses the plane of the Earth's orbit twice in every revolution (which point of intersection is called its Node), so each must have an ascending and a descending Node, or a Node which they pass when coming into the Northern

\* The most apposite mode of representing the Heavens is by a spherical exhibition; for though it is irrational to consider the Universe as finite, yet the celestial space has an appearance of globularity in whichever way we view it, and the stars seem all set in the same dome, bearing different magnitudes. The Synopsis, however, is a planispherical delineation, where hemispheres placed back to back give a representation of the whole visible Universe, and exhibits the mode of the Planetary Revolutions.

Hemisphere,

Hemisphere, and the opposite when going into the Southern : these Nodes are characteristically marked in the Synopsis by  $\alpha$  the ascending Node in the Northern Hemisphere, and  $\vartheta$  the descending in the Southern.

In viewing the Synopsis, it must be conceived that those Stars which are greatest in magnitude are nearest to the Solar System, and most remote from the observer's eye, and that they form on either Hemisphere of the Synopsis (as they appear to do in nature) an Hemisphere, whose perpendicular radius is equal to the radius or semi-diameter of the Ecliptic Circle.

Although the Planets are projected in the Synopsis in their respective positions for one particular day, yet their positions for any other day may be easily ascertained by a reference to the annexed Table, which enumerates the periods they occupy in performing their revolutions ; and by measuring the period of revolution on the Synopsis, the situation of any particular Planet on any given day may be ascertained. As, for instance, by the time the Earth has effected one entire revolution and returned to the same place, as delineated in the Synopsis, which will occupy 365 days &c, Mercury will have completed four revolutions, and have proceeded 13 days 9 hours in a fifth, which is the  $6\frac{2}{5}$  part of his orbit : whereas, in the same period, Jupiter will

not

not have described one twelfth part of his orbit;  
and so of the rest.

For the sake of distinctness in treating of the  
component parts of the Solar System, and de-  
scribing their relative situations to each other and  
to the Fixed Stars, we will consider them sepa-  
rately. First,





## THE SUN.

Ethereal Godhead of revolving Worlds,  
 Fountain of Light, great Source of hallow'd Day,  
 Supernal Glory, and of prime most prime  
 Of th' heav'nly Orbs which deck Creation's  
 Scope! All hail thee Sire!!!

This Magnificent Orb, which is the \* central object in the Solar System, is represented in the Synopsis as centrically bisected, one half thereof appearing in the Northern Hemisphere and the other in the Southern. The bulk of this august body is so great, that he surpasses in magnitude the combined bodies of all the Planets and Satellites of our System; whence it plainly appears, that as matter attracts in proportion to its quantity, it is the immensity of his material composition which causes the gravitation of the various Planets of the System to him as their centre. Mankind, viewing with admiration the qualities he possesses, have indulged much speculative reasoning on his

\* Although he is the central object of our System, his position is not in the exact central point thereof, but swerves a little and is observed to make a small revolution round a centre, in like manner as the North Star round the polar point. This revolution of the Sun is thought to be occasioned by the influence which the Planetary Orbs are supposed to have upon him; but neither the period of his revolution, nor the eccentricity of its Orbit, have as yet been ascertained.

C

true

true essence; yet though their investigations have been productive of a variety of hypothetical theories, no definitive conclusion of his material quality has hitherto resulted from their labours: Sir Isaac Newton conceived the Sun to be either an inexhaustible mass of ethereal fire, disseminating radiance and heat throughout our System; or, in case of exhaustion, to be supplied by those Comets which have appeared to fall into his body. But many objections have been raised to these theories as being too hypothetical; and so inconclusive are the minds of our modern philosophers respecting the subjects of light and heat, that premiums are offered by our Royal Society for the best composition thereupon: yet whatever may be the peculiar quality of the Sun's inherent matter, of this we are assured, that he is the radiant fountain of light, and probably the genial source of animation; therefore, if his quality should forever remain a mystery to mankind, his properties are sufficient to command their admiration, their gratitude and their awe.

As in treating of the evolutions of the respective Planets, successive references to this prime mover, will be unavoidable, it is not here needful to notice his peculiar planetary influence: We therefore proceed to

*MER-*

*MERCURY:*

Cloath'd in ethereal Light, this fleeting  
 Orb contiguous to the Solar Fount,  
 Revolves: unknown of what Obliquity  
 His Pole, or if Rotation on his Axis  
 Makes, by such Effulgence veil'd.

This Planet, which is the nearest in the System to its august centre, revolves round him in an orbit whose inclination from the plane of the Ecliptic is  $6^{\circ} 54'$ ; the orbit of this Planet, therefore, intersects the plane of the Earth's orbit, and the Planet consequently crosses the plane of the Earth's orbit twice in every revolution; these Nodes or points of intersection of this Planet are,  $14^{\circ} 43'$  of Taurus the ascending, or advancing into the Northern Hemisphere; and  $14^{\circ} 43'$  of Scorpio the descending, or when declining into the Southern; when midway between either of these two Nodes he is either in his utmost northern or southern declination: in his farthest northern declination he will be  $6^{\circ} 54'$  above the Ecliptic, and his heliocentric\* position will be then  $14^{\circ} 43'$  of Leo; and when in his greatest

\* The Heliocentric place of a Planet is its position as seen from the Sun, and the Geocentric its place as seen from the Earth.



southern declination, his heliocentric situation will be  $14^{\circ} 43'$  of Aquarius. The period which Mercury occupies in making a revolution in his orbit, is less than three of our months; and, as appears by calculation, he, not only has a less orbit to circumscribe, but moves with greater velocity \* than any of the other Planets. His distance from the Sun, is computed at about 36 millions of miles, and, though at this prodigious distance, his orbit is much within that of the Earth; whence arises the inconsiderable angle which he makes with the Sun even at his greatest elongation, and the consequent difficulty of seeing him, as being always in the neighbourhood of the Sun, on account of the effulgence of the solar beams.

Thus far have the position and periodical evolutions of this Planet been pretty accurately ascertained; but there are others, such as the inclination of his axis to the plane of his orbit, and the period of his diurnal rotation, which from his proximity to the Sun, are desiderata hitherto beyond the power of human attainment.

The position in which Mercury is projected in the Synopsis is his true position for the 21st of June, when his heliocentric situation is  $21^{\circ} 7'$  of

\* The motions of the Planets in their orbits decrease in proportion as their orbits are remote from the Sun.

Aquarius, and his geocentric  $8^{\circ} 3'$  of Gemini. Although the places of the Planets are calculated on the Ecliptic circle, yet they seldom appear thereon, on account of the obliquities of their orbits, but are either North or South of that circle. Mercury's situation on the day in which he is projected, is above  $6^{\circ}$  South of the Ecliptic Circle, having only advanced  $6^{\circ} 24'$  from his position of greatest southern declination; it is therefore laid down in the Southern Hemisphere.



*VENUS.*

## VENUS.

Anon she shines resplendent in the East,  
 As orient token of the rising Sun,  
 Anon in occident, with astral glow  
 In claritude above the starry host,  
 Decking Vespertine sky.—

Second from the Solar centre, revolves this Planet, in an orbit  $7\frac{1}{10}$  of the distance of our Earth, and  $1\frac{3}{4}$  the distance of the former Planet. The obliquity of this orbit to the plane of the Ecliptic, is  $3^{\circ} 20'$ , wherein she performs a revolution in  $224^h 17^m$ , crossing the plane of the Earth's orbit twice in every such period; in the points of the Ecliptic  $13^{\circ} 59'$  of Gemini, when ascending into the northern hemisphere, and  $13^{\circ} 59'$  of Sagittarius, when descending into the southern: Should the Earth happen to be in one of these points of the Ecliptic at the exact time with Venus, the latter being an interior Planet, would, like Mercury, appear to us making a transit across the face of the Sun; — or, if either of them should be in their Node, at the exactly opposite point of the Heavens to that of the Earth, they would then appear to pass behind the Sun, and become invisible to us from the interposition of his body. The revolving motions of both these interior planets are so rapid, that transits occur but rarely, and are of very short duration:



the last transit of Venus happened in 1769, and the next, according to computation, will not arrive till 1874.

The inclination which the axis of Venus observes from a perpendicular to her orbit, is 75 degrees, so that she is only 15 degrees from an horizontal position; wherefore the inhabitants of this Planet, must be exposed to greater extremes in the variation of their seasons than we are. Venus in her highest point of northern declination, is in  $13^{\circ} 59'$  of Virgo, which she reaches in 56 days from her ascending Node; and when in that position, has the Sun shining directly on her southern hemisphere, at which time she is only 15 degrees from being vertical at the South Pole; while the northern pole remains for several days in obscurity: the like takes place in a reverse manner when the Planet is in the opposite point of her orbit.

From the various transits which these two Planets have made across the Solar disk, and the minute observations which have been made on them at those periods, it is ascertained that neither of them is accompanied with a lunar Satellite; since if either of them had such an attendant, it must have appeared with its primitive Planet, exhibiting a transitory opaque macula upon the bright body of the Sun.

As

As Venus revolves in an orbit interior to ours, and receives all her light from the Sun, we are never enabled to see her luminated Hemisphere replete; but through telescopes she appears with various phases, sometimes as a fine crescent, which continually increases till she becomes gibbous, or like the appearance of the Moon between half and full; she in like proportion diminishes till she becomes invisible, being then between the Earth and Sun, but not in a position parallel to the Earth's orbit: she happens to be in a part of her orbit which is South of the plane of the Earth's orbit on the day in which she is projected in the Synopsis, therefore she is delineated in the Southern Hemisphere, and we have a view only of her Southern Hemisphere. The order of the Signs points out the course of the Planet's revolutions, which in this southern hemisphere appears the reverse of the Northern, and would appear so in nature from a correspondent site.

THE



Third from the hallow'd Fount of holy light,  
Thro' space ethereal 'volves our native orb;  
Stupendous Globe! with animation charg'd:  
Eliptic journs, inimitably poiz'd  
'Twixt gravitation and the solar force.

This third Planet from the majestic centre of the Solar System, performs its annual revolution in an orbit of great circumference, though inconsiderable when compared to the orbits of the superior planets. The level or plane of the Earth's orbit, is represented in the Synopsis by the plane or surface of the delineation, and is the datum from which the obliquities of the orbits of all the other Planets, are computed.— If this plane is extended in imagination as far as the Fixed Stars, it will form that ideal circle in the Heavens which is called the Ecliptic, and is the Plane of the Earth's path delineated by the Stars, and the line in which we always see the Sun: it is termed the Ecliptic, because Eclipses can only occur to us when our lunar satellite revolving in its orbit, crosses the plane of the Earth's orbit either at conjunction or opposition\*.

The

\* When the Moon is in either of her Nodes (that is, crossing the plane of the Earth's orbit), at her conjunction or change,



The Earth in its orbicular course round the Sun advances about one degree per day, which apparently contributes to the Sun the same motion, as they appear invariably to each other in exact opposite points of the Ecliptic. On the day for which the Planets are projected in the Synopsis, the Sun appears to us in the first degree of Cancer, and to an eye placed in the Sun, the Earth would appear in the opposite point of the Heaven, viz. in the first degree of Capricorn, and though placed centrically in the System, and immensely remote from any of the Fixed Stars, yet, through the imperfection of human vision, it appears like them a fixture, and with them equally distant in one great dome of Heaven.

In the Synopsis, it is very easy to imagine the orbit of the earth by conceiving it to be in a circular motion round the Sun, preserving ever the same inclination of its axis to the North Polar point in the Heavens, so plainly pointed out by the two leading Stars in the constellation called

change, she then comes diametrically between the Sun and Earth, and thereby causes to us a temporary eclipse or obscuration of the body of the Sun: and when she is in one of her Nodes at opposition or full, the Earth is then immediately between her and the Sun, and prevents the solar rays acting directly upon our reflecting satellite, whereby she appears to us eclipsed, being immersed in the shadow which the Earth casts behind it.

Ufra Major, as appears in the Synopsis. This elucidates the variation of our Seasons, since, by the inclination of the earth's axis, the Sun is now in its most northern declination, or shines vertically on that part of the Earth which lies under the tropic of Cancer: as it advances in its orbit it presents the more southern part of its body to the Sun's centre, and in about 90 days will have revolved about one quarter of its circumference, and the Sun will then make an equal angle with either Pole of the Earth, and shine vertically on the equatorial part of our Globe: still advancing with an observance of its due inclination, it will arrive in the opposite point of the Heavens on the 21st of December, and its South Pole will then be presented to the Sun in a correspondent manner, as its Northern is in its present delineation in the Synopsis; here the Earth and Sun will be reversed as to the points of the Ecliptic in which they will appear. The inhabitants of the Earth will see the Sun in the first degree of Capricorn, and to an eye placed in the Sun, the Earth will appear in the first degree of Cancer; the Sun will be (as it is termed) in his greatest Southern declination, and will shine vertically on that part of the Globe which lies under the Tropic of Capricorn, it will then be winter to the inhabitants of the Northern Hemisphere, and summer to those in the Southern.

The Earth, ever continuing in its revolving course, will advance in its orbit to that situation where the Sun again will be vertical on its Equator, and impart an equal diffusion of his rays to the Northern and Southern Hemispheres. The Earth proceeding in her revolution, will in 365 days 6 hours, have passed through the 360 degrees of the Ecliptic, and again arrive at that point of the Heavens in which it is represented. This motion is continual; and during the period of one revolution, it will have performed  $365\frac{1}{4}$  rotations on its axis, completing a rotation in 24 hours, thus successively presenting the various parts of the Earth to the Sun's face, and alternately exposing them to the shade of night. In contemplating the Heavens, we find that any particular Star sets sooner each succeeding night; this is occasioned by the Earth's motion in its orbit, as will appear plain by the Synopsis; for as the Earth travels from the West to the East in its direct motion (and that at the rate of nearly one degree per day), we consequently shall find every star nearly one degree more to the Westward on one evening than they were on the evening preceding; and those which passed our Meridian at midnight, within 6 months from that time, will pass the Meridian at mid day.

Though the diameter of the orbit which the Earth describes in its revolution round the Sun,  
is



is 190 millions of miles, and the inclination of the Earth's axis is invariably  $23\frac{1}{2}$  degrees from a perpendicular to its orbit, yet the directions of our Poles are ever true with the celestial Polar Points: an incontestable proof of the infinite distance of the fixed Stars, which do not, in the least, vary their position to us from whatever part of the orbit we view them.





In silent night the Lunar Lamp of Heav'n,  
Fair sister of the golden Orb of day,  
Steals round her circling orbit and illumines  
The shaded Earth, receiving brightness from  
Th' irradiant Sun, in fair reflection does  
Impart to Earth a second day.—

Though this luminous orb is considered but as a Secondary Planet in the Solar System, yet it is more immediately essential to the inhabitants of the Earth than any of the primary ones. It is attached to our Planet by that invisible and universal agent, Gravitation, revolving round it in an orbit at the distance of 240,000 miles, and accompanying it in its revolution round the Sun.

The Plane of the Moon's orbit is not coincident with that of the Earth, but inclines from it in an angle of 5 degrees; it is therefore that we sometimes see her so high in the Heavens, when in the meridian, and sometimes so much nearer the horizon. If her orbit was parallel to the plane of the Earth's orbit, we should invariably have two Eclipses every Lunar month; an Eclipse of the Sun at every change or conjunction, when the Moon is between the Earth and Sun; for, being upon a parallel line, she would by her interposition naturally intercept those rays of light which were  
coming

coming directly to us, and consequently conceal the body of the Sun from our view;—and an Eclipse of the Moon at every full or opposition, when the Earth is directly between its Satellite and the Sun: in that case the body of the Earth would intercept the direct solar rays from impinging on the Moon, and consequently that Satellite would become eclipsed.

As the body of the Sun is immensely larger than that of the Earth, the shadow of the Earth is not cylindrical but conical, converging to a point in a situation without the orbit of the Moon; it is however much tapered at the distance of the Moon's orbit; and as the Sun's direct rays pass on either side the body of the Earth, they are, by the peculiar property of our atmosphere, refracted through the Earth's shadow, whereby the shadow is a little enlightened, and is the reason why the Moon is (dimly) visible during a Lunar Eclipse.

In a total Solar Eclipse, the body of the Moon conceals the whole disk of the Sun; but from the small dimensions of the Moon's shadow upon our Earth, the greatest part of our atmosphere remains enlightened, by the refrangibility of which we suffer a very inconsiderable diminution of light.

The motion of the Moon in her orbit, is very perceptible to a common observer: if we remark her position at any particular time at night, we shall find that on the following evening, at the  
same

same hour, she will be  $13^{\circ}$  to the eastward of that position, or 52 minutes in time, invariably observing this progression through her orbicular course.

The Synopsis adequately exemplifies the cause of the various phases of the Moon, since, as she is an opaque body revolving round our Earth in an orbit nearly coincident with our own, and with her enlightened hemisphere always turned towards her illuminator, the Sun, she must, as half of her orbit is within the Earth and half without it, consequently present to us various portions of her illuminated side.

When the Moon is in that part of her orbit in which she is represented in the Synopsis, she appears to us in the character of half-moon, having just arrived at her first quarter on the day for which she is there projected. In seven days from that time she will be in the exterior point of her orbit, and in opposition to the Sun, shining upon that part of the Earth which is turned away from the Sun with a full and luminous face, from which period she will decrease gradually in her luminous appearance, and, in the space of about fourteen days, will become invisible, being then in that point of her orbit which is between the Sun and Earth, and consequently her unenlightened hemisphere opposed to us.

*MARS.*



*MARS.*

Unsuited with a satellitious Moon  
 T'attend his course or 'lume his nocturn sky,  
 Alone revolves this rubicund small Orb  
 With fiery mien as portentous of war.

Of the various Planets which appertain to our System, that which is least gifted with phenomena discernible to the inhabitants of the Earth, is the Planet Mars. It circumvolves the Sun in an orbit superior to the Earth's, and with an obliquity thereto of  $1^{\circ} 52''$ : his bulk, however, is much inferior to the Earth's, and otherwise seems to yield in consequence (as an habitable world) to the Planet whereon we dwell, by being destitute of a Satellite, or at least none such has hitherto been discerned by human vision; and as Astronomers have discovered those of much superior Planets, it becomes a fair conclusion, that Mars is excluded from such an attendance. His Nodes, or the points where he intersects the plane of the Earth's orbit, are  $17^{\circ} 17'$  Taurus ascending ( $\Omega$ ) and  $17^{\circ} 17'$  descending ( $\vartheta$ ). But as the Sun is of so much superior bulk to the Earth, the shadow of his body must terminate in a conical point long ere it reaches the orbit of Mars, therefore if they should be both in the same point of the Ecliptic at the time that Mars is in either

E

of



of his Nodes, there can be no eclipse of this Planet; and his Orbit being superior to that of the Earth, he cannot make a transit across the Sun's disk, but, like the other Planets, he becomes occult behind the body of the Sun annually; as, however the general diffusion of his light, during the time the Sun sojourns above the horizon, frustrates our diurnal view of the minor glories of the Heavens, the egress or ingress of such exterior transits cannot be discernible; but, as the Moon does not possess such irradiance, all transits behind the body of that Satellite, are distinctly visible; and, with this Orb, the occurrence may take place without either of them being in the Ecliptic.

The Orbit of Mars is so extensive that he describes very little more than half of his circumference during the period of our year; the time he employs in performing a rotation on his axis is now found to be about  $23\frac{1}{2}$  hours, though formerly supposed to be  $24^h 40^m$ ; and the inclination of his axis to his orbit has lately been discovered to be  $28^\circ$ . The obliquity of his orbit to the plane of the Earth's not being quite  $2^\circ$ , he consequently is always found in the vicinity of the Ecliptic; and from his ruddy appearance and motion among the Fixed Stars, may without difficulty be discovered, though small in his appearance. His heliocentric position in the Heavens on the day for which he is projected  
in

in the Synopsis, is  $23^{\circ} 48'$  of Capricornus, and his geocentric  $4^{\circ} 23'$  of Pisces.—

It is laid down in the projection of the Southern Sideral Hemisphere, because he has passed his descending Nodes  $17^{\circ} 17'$  Scorpio, and is on the day of his delineation, south of the Plane of the Earth's Orbit.



Great Jove, amidst the host of astral gems  
That, glitt'ning, strew the vaulted Sphere of Heav'n,  
A twinkling Star t'unaided vision seems ;  
To fight, assisted by magnific lens,  
A World! its faithful character, with lunar  
Orbs, in sportive rotary, revolving  
Round their central Primitive.

Of all the other superior Planets of our System, that which is most interesting (from its utility) to the inhabitants of the earth, is the Planet Jupiter, not on account of the particular evolutions of the Planet itself, but of his attendant satellites, of which there are four revolving around him in different orbits, but are nearly parallel to the plane of the Ecliptic. Their great utility to the inhabitants of our Globe is in determining, with accuracy, the longitudes of places upon the Earth's surface; for as the periods of the eclipses of these satellites, are accurately calculated for the meridian of London, and annually published, it remains but for persons resident or voyaging in different parts of the world, to ascertain the exact point of time the same are visible there, and reduce the time into space (i. e. 4' time to 1° space) when the Longitude East or West of the Meridian of Greenwich, is acquired.

The

The orbit of this Planet is inclined from the plane of the Ecliptic in an angle of  $1^{\circ} 20'$ , and the places where he intersects the plane of the Earth's orbit, are in  $7^{\circ} 20'$  of Cancer, when ascending, and  $7^{\circ} 20'$  of Capricorn, when descending. He occupies about twelve of our years in describing the circumference of his extensive orbit; he also makes a rotation upon his axis, but differs much, both in point of the velocity of his motion, and the inclination of his axis to the rotation of the Earth; he perfects one rotation in rather less than ten of our hours, the performance of which is easily perceived with a good telescope, on account of those distinguishing marks which environ his body, commonly called his belts; these are parallel to his orbit, and at right angles with his axis. These cinctures, as also some singular maculæ which are observable on his surface, tend to strengthen the idea of this Planet's being a habitable World; and the lunar satellites, with which it is attended, add further authority to the conjecture that it is graciously designed for the habitation of material beings; for no other conception can be formed of the purport of these appendages, than the illumination of that particular Planet for which they appear qualified and designed: we must be at least fully sensible that they were not ordained to cast a single ray of light on our Globe, since they are  
not



not even discernible by its inhabitants, except through the medium of artificial light.

The axis on which this Planet performs its diurnal rotation, is perpendicular to its orbit; whence it possesses no variation of season.

This Planet is also projected in the Southern Hemisphere of the Synopsis, because on the day for which it is laid down, it is in that part of its orbit which is South of the plane of the Ecliptic.

*SATURN*

*SATURN.*

Around this globe play sev'n revolving Orbs  
 With one bright zone, encircling, unattach'd ;  
 Fair to the visual sense, of golden mien ;  
 Yet of its composition or design  
 Conjecture, forms the sole analysis.

This Planet which revolves in an orbit very superior to that of Jupiter, occupies nearly thirty of our years in describing his circumference: the inclination which this orbit bears to the plane of the Ecliptic, is  $2\frac{1}{2}$  degrees, and the points where he intersects it, are  $21^{\circ} 13'$  of Cancer when ascending into northern declination, and  $21^{\circ} 13'$  of Capricornus, when descending into the southern.

The inclination which the axis of this Planet, bears to its orbit, is not accurately determined, but is conceived to be at right angles with it.

That bright luminous ring which encircles the body of Saturn, inclines from the plane of the Earth's orbit in an angle of 30 degrees, by which obliquity it sometimes disappears from our view, and sometimes appears entire; but the whole of it is never visible distinctly from the body of the planet. It appears to us most open when Saturn, in his great revolution, has arrived at  $20^{\circ}$  of Pisces and  $20^{\circ}$  of Virgo, and when the Planet has reached  $20^{\circ}$  of Gemini and  $20^{\circ}$  of Sagittarius, the ring is turned edgewise to our view, and its

8

surface

surface is so singularly flat that it appears like a silver thread across the body of the Planet.

The seven satellites which revolve round Saturn, perform their circuit nearly on the parallel of his orbit; they confer on this Planet, doubtless, a very material light, but are not of that benefit to ours, which the satellites of Jupiter are, on account of the remoteness of Saturn's orbit requiring a very highly magnifying power to discover the eclipses of his satellites.

In the Synopsis we have a Southern view also of this Planet, because on the day for which he is thus projected, he happens to be in a part of his orbit which is South of the plane of the Ecliptic.

The heliocentric and geocentric places of this Planet for that day differ but little, the first being  $15^{\circ} 2'$  of Cancer, and the other  $13^{\circ} 33'$  of the same sign.

The rotation of this Planet on its axis, is but a new discovery, and the period is found to be ten hours and forty minutes.



## THE GEORGIUM SIDUS.

High in the System, circumvolving all  
The Planetary Orbs, this new-born World  
In great Circumference makes, with course so  
Distant, that in Heav'n's expanse to view  
It seems but as a minor Star.

The discovery of this Planet, so indistinctly visible in the field of Heaven to the unassisted eye, is a pleasing testimonial of the progress of Astronomy and the magnifying power of Optics: from the very great remoteness of its orbit, upon its first observance only two Satellites appeared to attend it; but considering the deficiency of the Sun's light at that extreme distance, it was natural to conceive that it must be attended with as complete a suite, at least, as any of its inferior Planets. And it appears a curious circumstance, that, since its first discovery, in March 1781, no addition to its suite has been observed till within these few months; its primitive terrestrial observer, Dr. Herschell, has now discovered, that it is encircled by two luminous rings (similar to that of Saturn), but crossing each other at right angles: he likewise, in addition to his former discovery, has observed some new Satellites revolving round it; and what adds wonder to their appearance is, that they seemed to him to revolve round this Planet in an opposite direction to the usual revolution

F

lution



lution of the Planets and their Satellites. If this is truly the case, and does not arise from an error in vision, it will be a new phenomenon in Astronomy. But further observation will be requisite to ascertain whether they have such contrary revolution or not.

The Distance of the orbit of this Planet from the Sun, is computed at 18 hundred millions of miles; whence arises its diminutive appearance, it being nearly five times larger than our Earth. This orbit is more nearly parallel to the plane of the Earth's orbit than that of any of the other Planets, inclining therefrom only 46 minutes: it is so very extensive, and the Planet's motion therein so slow, that it is computed to occupy above 80 of our years in performing a revolution: it has not yet passed through three Signs of the Ecliptic since its first discovery. The point of the Ecliptic wherein it is visible on the 21st of June as projected in the Synopsis, is  $14^{\circ} 3'$  of Virgo, as seen from the Earth; and  $17^{\circ} 32'$  of the same Sign, as seen from the Sun; from both of which situations its position would appear North of the plane of the Earth's orbit, and it is therefore projected in the Northern Hemisphere.

*OF COMETS.*

'Loft in the fpangled cope of Heav'n ethereal,  
 'Midft the range of number'd Stars, appear thefe  
 Errant Orbs—fleeting to faturate with  
 Solar heat, or too ignited bend their  
 Courfe thence, to regions where no mortal eye  
 Can trace.

Of all the various phenomena with which the prolific womb of nature, is fo exuberantly ftored, perhaps the Cometary Orbs are to man the moft extraordinary; ranging as they do through infinite fpace, with Orbits fo eccentric, and with rapidity fo incalculable.

It is obferved that they approach our Syftem in all directions, advance towards the Sun, turn round that great body with increafed velocity, and then depart from our Syftem in the fame hemisphere in which they entered it. Thus the Orbits of Comets are not circular, but very long elipfis, whence it is conceived that as they are known to extend beyond our Syftem, they reach as far as the Suns of other Syftems in the Univerfe, and revolve round them in a correspondent manner to that in which they revolve round our Sun, and thus perhaps range from Syftem to

F 2

Syftem

System throughout the Universe, or are probably actuated only between two particular Systems. This hypothesis is rationally grounded on the circumstance of particular Comets having been observed to depart from our System, and after an interval of years, being found to return and visit us again; but, although there have been at least twenty different Comets visible to the inhabitants of this Planet at various times, yet the periodical returns of three only have been calculated with any degree of exactitude: nor is it ascertained precisely, whether the one which engaged our attention last Summer had ever before offered itself to the notice of terrestrial beings. This Comet, according to the account we have received, was first discovered by *Monf. Lalande*, a French Philosopher, on the 14th August 1797, situated about  $9^{\circ} 30'$  north of the Ecliptic, with  $95^{\circ} 31'$  right ascension. No information had been received in England of this discovery, till after the same had been made here by the ingenious *Mr. Walker, Jun.* on the 18th of the same month, when its position was near the Pole of the Ecliptic, having traversed about  $80^{\circ}$  in the intervening time. From the observation of *Monf. Lalande* it appears, that its ascending Node must have been about the end of Gemini or beginning of Cancer, and that it had passed this sign but a few days  
previous



previous to its discovery. On the 19th, at 12 at Night, it had advanced about  $14^{\circ}$ ; and on the 20th, at 10 P. M. about  $6^{\circ}$  more; on the 22d, at 9 P. M. it was in the situation as delineated in the Synopsis, from which time no accurate observation could be made, partly on account of the obscuration of the Heavens by Clouds, and likewise as its motion was then retrograde from the Sun, it obtained such remoteness from its Orbit that it became lost in diminution. What has made this Comet particularly notable is, that it was observed to pass the Orbit of the Earth but a month previous to the Earth's arrival at that particular place. If these two Orbs, in such rapid motion, had clashed together, the result of such a collision is difficult to divine; but most probably, it would have been fatal to our Planet, or at least to its Inhabitants.

*THE FIXED STARS.*

These astral lustres of the azure Heav'n,  
 Coruscant rays of septennary hue,  
 To vision 'pear as brilliants form'd to  
 Deck th' ethereal canopy: studding  
 The cope celest with Rubies, Topaz,  
 Emeralds and Zapphires, Amethists  
 And adamantine gems, dignant of high  
 Empyreum. To minds philosophic  
 Yet nobler seem, more worthy place in Heav'n,  
 Of admiration worthier on Earth;  
 As centric Suns, vivific source to worlds  
 In systematic order 'volving round,  
 But yet unborn to mortal sight account  
 Their great remoteness and unnative light.

These brilliants of Heaven, which appear like  
 spangles set in the great celestial dome, equally  
 distant from us, though differing in magnitude,  
 pass, by that appearance, a deception on our  
 visual senses; for observation has discovered them  
 to be remote even beyond the extension of our  
 imagination, since numbers are insufficient to ex-  
 press their distance: they are supposed to be all  
 equal in magnitude; but those which appear to  
 us diminutive have that appearance occasioned by  
 a superior extension of their position.

The Fixed Stars are represented in the Synopsis  
 on a flat surface, but in either projection, are de-  
 signed to represent an Hemisphere; those to the

North of the plane of the Earth's orbit in one projection, and those on the South of it in the other: it must be left for the conception of the reader to represent them in his mind as forming each a concave dome over the Solar System, for such would be their appearance to the human eye when viewed from any part of the System.

The ancients have particularized the various clusters and groups of Stars by representing them under the figures of men, beasts, &c. but in people of modern taste it requires as much ingenuity to trace among the Stars the outlines of the constellations as it did invention in the ancients to design them. We have therefore omitted (in the Synopsis) the representation of those constellations, but have inserted the names of some of the most eminent in either Hemisphere.

Though many of the Fixed Stars appear to us brighter and larger than some of the Planets, yet, from telescopic observation, we are assured that their positions are more remote; and from their immense distance from our Solar Centre, it is ascertained that they cannot reflect the Sun's light; therefore it is conceived that they possess themselves that innate property with which our Sun is endued, and that they each distinctly illumine and give planetary motion to a system of worlds revolving round them; in like manner as our august  
centre

centre confers his motory influence on his surrounding Planets.

What an amazing idea to contemplate so many millions of worlds all in rapid motion; and how much too great for the human mind to form a conception of the immensity of that space whither these orbits extend ! But they are the work of that Being whose centre is every where, and whose circumference no where, whose works immaculate extend to the infinity of space, and indelibly endure to the eternity of time !



FINIS.

8





The Ceres Ferdinandea, was discovered by Piazzi, of Naples, in 1801. This Planet situated between Mars and Jupiter, is not one twentieth the part so large as Mars, and is 285 millions of miles distant from the sun, around which it performs its revolution in four years, seven months, of true days. —

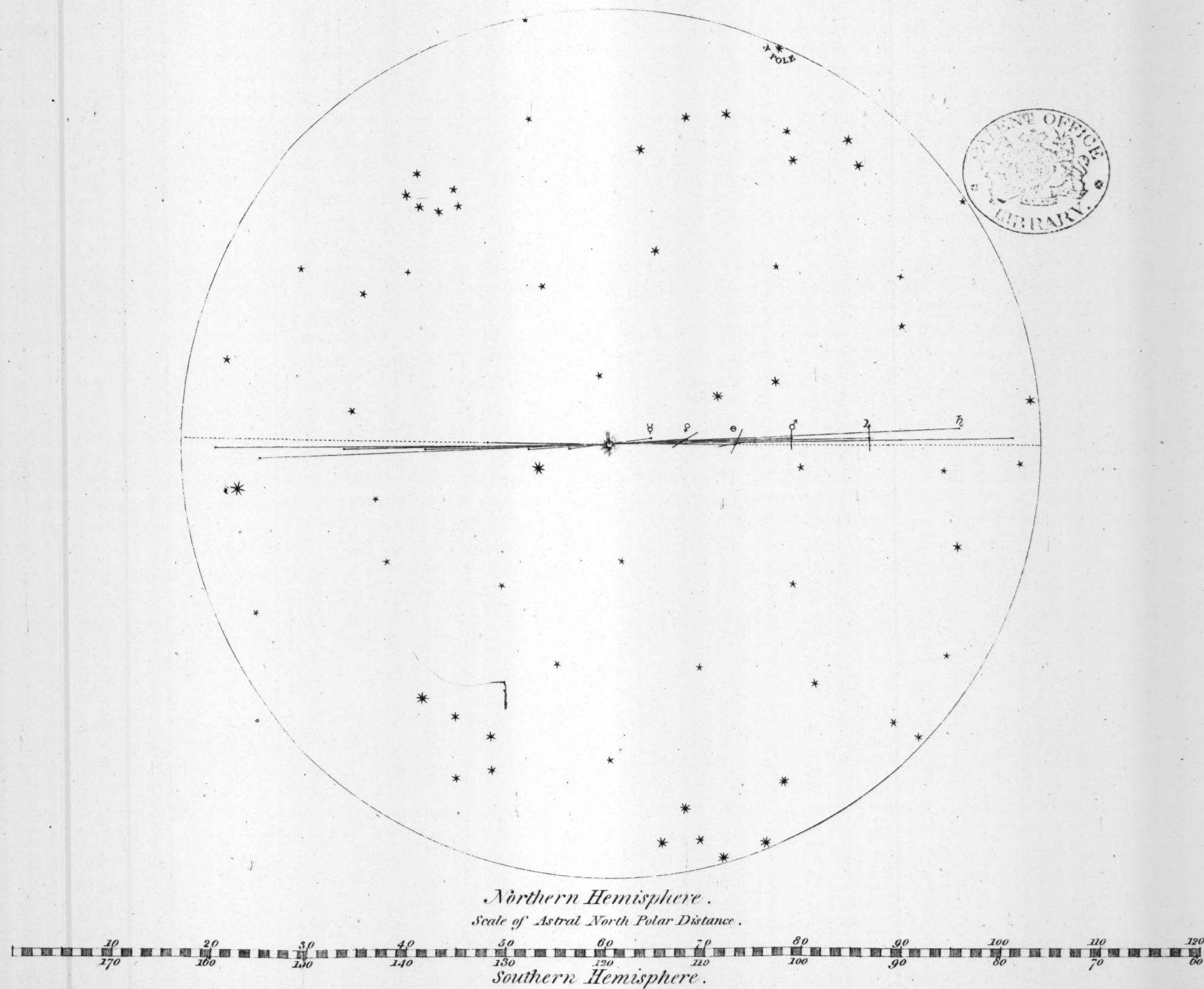
— The Pallas was discovered by Olbers, a German Physician, in 1802. It has a diameter of 3,200 miles, is distant from the sun 298 millions of miles, revolves round the sun in four years & 8 months & 3 days, its supposed diurnal rotation is twelve minutes, forty seconds. —

The Juno was discovered in 1804, by Harding, a German, of the neighbourhood of Brunswick. The diameter of this Planet is still smaller than that of the former, being only 1,325 miles. The precise distance from the sun is

is computed to be 300. millions of miles  
across which it revolves in four years  
of four months. — The last discovery of  
this kind was effected at Paderborn in  
1807. who first brought the Vesta within  
the sweep of his telescope, considered it  
as a star of the fifth or sixth mag-  
nitude. Dr. Herschel is of opinion that  
this and the three former viz. Ceres  
Ferdinandea, Pallas, and Juno,  
~~ought, on account of their~~ <sup>inferior.</sup> size to be  
considered as asteroids rather than  
as stars. — Comets. It is computed  
that there are 31. comets appertaining  
to our system. returning at different  
intervals of 75. 128. 575 years. That which  
appeared in 1680. was computed to be distant  
from the sun, 11.000.000.000. greater distance  
— and its least. 450.000. On its approaching  
to the former, its velocity is equal to  
980.000 miles in one hour. —



Section of the Universe  
*Exhibiting the inclinations of the Axis and the Orbits of the Planets of the*  
**SOLAR SYSTEM.**



# T A B L E

OF THE

Particular EVOLUTIONS and INCLINATIONS of the PLANETS of the SOLAR SYSTEM.

PLANETS.	Period of Revolution.			Diurnal Rotation.	Mean Distance from the Sun.	Inclination of Axis to Orbit.	Inclination of Orbit to Ecliptic.	Ascending Node.	Point of greatest Declination		Descending Node.
	Years.	Days.	Hours.						North.	South.	
Mercury	0	87	23	unknown	36,000,000	unknown.	6° 54'	8 14° 43'	♊ 14° 43'	♎ 14° 43'	♎ 14° 43'
Venus	0	224	17	23 30	68,000,000	75° 0'	3° 20'	♏ 13° 59'	♏ 13° 59'	♌ 13° 59'	♌ 13° 59'
Earth	1	0	0	24 0	95,000,000	23° 29'	parallel.				
Mars	1	321	17	23 39	145,000,000	28° 0'	1° 52'	♏ 17° 17'	♊ 17° 17'	♎ 17° 17'	♎ 17° 17'
Jupiter	11	314	18	9 56	494,000,000	0° 0'	1° 20'	♏ 7° 29'	♊ 7° 29'	♌ 7° 29'	♌ 7° 29'
Saturn	29	167	1	10 40	907,000,000	unknown.	2° 30'	♏ 21° 13'	♊ 21° 13'	♎ 21° 13'	♎ 21° 13'
Georgium	81	37	12	unknown.	1,816,000,000	unknown.	0° 46'	♏ 12° 49'	♊ 12° 49'	♌ 12° 49'	♌ 12° 49'





PATENT OFFICE LIBRARY

